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From the Great Wall to the Great Collider: China and the Quest to Uncover the Inner Workings of the Universe

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From the Great Wall to the Great Collider

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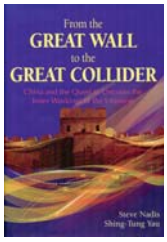

Steve Nadis and Shing-Tung Yau

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We are living in an era of a new China—one that has changed completely and permanently in the wake of the economic boom it experienced in the past few decades. Its ancient tranquil landscapes have been supplanted by skyscrapers connected by a network of high-speed trains. This wealthier China has also generated many noteworthy scientific discoveries with a correspondingly large number of applications. Now those involved in the nation's scientific community are contemplating the profound contributions that China—one of the oldest known civilizations—could make to our scientifically and technologically driven world.

China's glory is still largely buried in the tombs of ancient emperors. Most cities have yet to uncover their archaeological treasures—one exception is Xian, with its display of Terracotta Army soldiers from the Qin dynasty. Another visible wonder is the Great Wall of China, which was built in the course of thousands of years by many generations of Chinese. It is the single largest construction project ever completed on Earth. But the time for building walls in China has long passed and given way to new, ambitious proposals for international megascale projects.

Among them is China's plans to build a "Great Collider," a next-generation multinational particle accelerator research facility consisting of a proposed circular electron–positron collider (CEPC) and a super proton–proton collider (SPPC). Science journalist Steve Nadis and Harvard University mathematics and physics professor Shing-Tung Yau discuss that proposal in their beautifully written book, *From the Great Wall to the Great Collider: China and the Quest to Uncover the Inner Workings of the Universe*. As a professional astronomer, I find the book suitable for students and professionals in any field of physics who want to understand the new frontiers in particle physics and astronomy.

From the Great Wall to the Great Collider describes the physics that links the universe, including the particles from the epoch of the Big Bang and the ones being studied today at CERN's Large Hadron Collider. Its first three chapters are "Smashing Atoms," "Chasing the Higgs," and "Beyond the Standard Model." Throughout, abstract physical principles are intertwined with pertinent stories of their discoveries, which makes reading the book an enjoyable, engaging experience. The three chapters provide enough background material for students to understand the key concepts and predictions of the standard model and beyond and the techniques used to test them experimentally. The ideas from particle physics, in turn, are necessary for understanding such concepts as dark matter and dark energy.

The proposed accelerator facility is discussed in the next three chapters. Chapter 4, "China on Center Stage," reviews the country's historical contribution to modern physics and several of its ongoing physics experiments. The success stories of the Beijing Electron–Positron Collider and the Daya Bay Reactor Neutrino Experiment have paved the way for the brave CEPC–SPPC concept, which is discussed in chapter 5. The proposed Great Collider would be a "quantum leap," according to the authors.

In chapter 6, "The Most Amazing Spinoff of All," the authors provide several examples of how particle-physics experiments have led to technical advances that benefit society. For example, the Web, which emerged from CERN, has changed the world of communications and reshaped the global economy. It is a wonder that great companies, like China's Alibaba.com, could actually trace their roots back to CERN.

The CEPC–SPPC concept has been an international quest from the beginning. Led by Yifang Wang, director of the Beijing-based Institute of High Energy Physics, the project is expected to involve thousands of scientists and engineers from all over the world, many of whom would be working onsite in China. From that point of view, the proposal is also a quantum leap to a future in which China will help lead international efforts to understand the universe. A project of that scale is likely to change humanity in some unexpected and unpredictable ways.

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